

REMARKS

The courtesy of the Examiner in granting the interview of March 21, 2007, and the helpful comments proffered at that time is noted with appreciation. Claims 1, 6, 9 and 10 are amended and claims 2 and 8 are cancelled without prejudice by the foregoing amendments. Claims 1, 3-7, 9-14 and 16-18 are pending in the application of which claim 1 is independent. Claims 1-14 and 16-18 have been rejected. No new matter has been added and no new issues are raised.

Claim Amendments

Claim 1 is amended to include the subject matter of dependent claims 2 and 8. Further, claim 1 is amended to clarify the arrangement of the array of circular cross section rods disposed in a flow passage of the claimed flame arrester.

Claim 5 is amended to correct claim dependency and claim 9 is amended to change claim dependency caused by the cancellation of claim 8.

Rejections under 35 USC § 103

Claims 1-14 and 16-18 have been rejected under 35 U.S.C. 103 as being unpatentable over FR526178A in view of U.S. Patent No. 2,068,421 to Long et al. (Hereafter "Long"). Claim 3 has been rejected under 35 U.S.C. 103(a) as being unpatentable over FR526178A in view of Long and further in view of WO9205946A. Claim 7 has been rejected under 35 U.S.C. 103(a) as being unpatentable over FR526178A in view of Long and further in view of JP403054354A. Claims 10 and 11 are rejected under 35 U.S.C. 103 as being unpatentable over FR526178A in view of Long and further in view of U.S. Patent No. 5,331,943 to Ko (hereafter "Ko"). Claims 12 and 13 are rejected under 35 U.S.C. 103 as being unpatentable over FR526178A in view of Long and further in view of U.S. Patent No. 4,437,968 to Elliot, (hereafter "Elliot"). Applicant respectfully traverses the rejections.

Claims 1-14 and 16-18

Claims 2 and 8 are cancelled and therefore, Applicant considers the rejection of claims 2 and 8 moot.

Applicants respectfully point out that they are aware of the FR526178A reference as it has been applied in the corresponding foreign counterparts of this application. As such, Applicants are familiar with the teaching of FR526178A and submit the following arguments that were effective in overcoming the application of this reference in the corresponding foreign cases.

First, circular section rods are *prima facie* less advantageous than polygonal section rods in that the ratio of surface area to volume is reduced. Thus, for the same weight of metal rod, there will be less heat absorption surface.

Next, FR526178A does in fact illustrate circular section rods at figures 1 and 2. The disclosure in Long is simply cumulative of this, and therefore the correct point of reference for the skilled person is to the circular section rods in the FR526178A, not Long. It is relevant that FR526178A shows the rods in a different configuration, one in which the rods are not in a generally co-aligned array. Therefore, if a skilled reader considers replacement of the polygonal section rods with circular section rods, they will see that FR526178A teaches an alternative configuration for circular rods. They will be taught to arrange those rods in alternate transverse layers. As such, FR526178A teaches away from “an array of adjacent circular section rods arranged in rows, each row being generally co-aligned and arranged transverse to the flow direction, such that fluids flowing in the passage must pass between the rods and the rods forming the rows are offset relative to rods in adjacent rows thereby to require a circuitous flow path for the fluids” as recited in Claim 1. That is, FR526178A shows different arrangements for the different types of rods. Circular section rods are to be arranged transverse and that aligned rods are to be hexagonal.

Thus, to arrive at the configuration set forth in the present invention, one must diverge from the disclosure of FR526178A, to contradict its teaching and dispose circular section rods in a co-aligned two-dimensional array. FR526178A states that only angled-section (polygonal) rods should be aligned in this way and that circular section rods are to be aligned transversely. One must also ignore the lesser heat absorption qualities of circular section rods and abandon the *prima facie* superior polygonal section rods.

More importantly, FR526178A does not disclose or suggest to one skilled in the art to substitute circular section rods in place of the hexagonal sectioned rods. Moreover, one skilled in the art would not be motivated to substitute circular section rods in place of the hexagonal

sectioned rods because of the structural and operational differences between the shapes in a flame arrester as recited in Claim 1.

The flame arrester of claim 1 has a structure, operation and function to extinguish an advancing flame front; what is relevant therefore is what the flame front “sees”. Therefore, the correct focus for our attention in this particular case is on the gaps between the rods, not the rods themselves.

Figure 3 of FR526178A illustrates a parallel array of hexagonal section rods. From the point of view of the flame; this is (topologically speaking) the open spaces between the parallel array of hexagonal section rods form a long narrow multi-path parallel-sided passage. Generally, the advancing flame front will be able to pass through this passage smoothly but with some deceleration to flow caused by the frictional effect of the adjacent walls. Heat will also be lost to the walls by conduction.

Now let us assume that the flame front is fast-moving, i.e., an explosion of detonation. A smoothly-flowing system will allow the flame front to progress quickly through the arrester, which will mean that the heat lost to conduction will be minimal. This will reduce the effectiveness of such an arrester in such situations, although they may be able to cope with a slow burn.

In contrast, Figure 1 of the instant application shows a different arrangement, one in which the previous parallel-sided flow path is replaced with one whose width continually varies. This configuration as recited in claim 1 and illustrated in Figure 1 offers a completely different quenching mechanism. The flow path of Figure 1 (i.e., the spaces between the circular section rods) creates much more turbulence and swirl for a fast-moving flame front. This is a direct result of the continually varying width. Among other factors, a venturi effect will be created, according to which the flow will accelerate in narrower parts and decelerate in wider parts. Flow is no longer smooth but becomes turbulent. This reduces the overall flow speed through the arrester of initially fast-moving flames thereby lengthening the dwell time and improving the heat extraction. Slow flow rates (such as whatever gas is meant to be flowing through the arrester) see no greater resistance to flow than the hexagonal arrangement, however.

An array of circular-section rods is, of course, merely an exceptionally simple and economic way of embodying the continuously varying width flow path of Figure 1. Simplicity of that nature suggests inventiveness, not obviousness.

To require the skilled person to contradict the teaching of FR 526 178 and move in a prima facie undesirable direction is to go beyond the limits of obviousness. Each would often be enough of its own, but the cumulative effect of both, and the reinforcement that is provided to the teaching of FR526178A by the skilled person's technical understanding, all combine to deter the skilled person from taking such a step.

Furthermore, there is no motivation to combine FR526178A and Long. Long teaches the same configuration of circular rods as disclosed in FR526178A. Namely, that circular section rods are arranged transversely. As previously argued, this is not what is claimed. The present invention recites "an array of adjacent circular section rods arranged in rows, each row being generally co-aligned and arranged transverse to the flow direction, such that fluids flowing in the passage must pass between the rods and the rods forming the rows are offset relative to rods in adjacent rows thereby to require a circuitous flow path for the fluids." This is clearly depicted in figures and described in the related sections of the specification. In contrast, Long like FR5265178A, has the circular section rods arranged transversely to each other. Figs. 6 and 7 of Long and depict arrays of tubes that are perpendicular to each other. That is, there is a one dimensional array of tubes 30 which are separated by another one dimensional array of tubes 29 that run perpendicular to the first array of tubes 30. The same arrangement is shown in Fig. 1 of FR5265178A.

To ignore these factors requires the examiner to ignore the content of the cited documents and engage in impermissible hindsight reasoning.

The inventor has however shown that both a transverse array and non-circular rods are in fact inferior in practice, if not in theory. Neither permits the easy and swift cleaning of the device that is, in use, essential. A flame arrestor on, for example, the exhaust pipe of a fork truck must be cleaned within hours, which means that known systems must be removed from the vehicle for cleaning. The claimed invention allows the vehicle to be used continuously for an entire shift before renewal is required.

There is no suggestion in the art that to contradict the teaching of FR526178A and Long and go against the skilled person's understanding can in fact yield these advantages. Accordingly, amended claim 1 is in fact not obvious in view of FR526178A and Long. Since claims 3-7, 9-14 and 16-18 depend from claim 1, claims 3-7, 9-14 and 16-18 incorporate each

and every element of amended claim 1. Thus claims 3-7, 9-14 and 16-18 are also not obvious view of FR526178A and Long. As such claim 1, 3-7, 9-14, 16-18 are in condition for allowance over FR526178A and Long.

Accordingly, Applicant respectfully requests the Examiner to reconsider and withdraw the rejection of claims 1, 3-7, 9-14, 16-18 under 35 U.S.C. §103(a).

Claim 3

Claim 3 depends from amended claim 1 and as such incorporates each and every element of claim 1. For the reasons discussed above Applicant respectfully submits that neither FR526178A nor Long teach nor suggest each and every element of amended claim 1. Specifically, FR526178A and Long fails to teach or suggest “an array of adjacent circular section rods arranged in rows, each row being generally co-aligned and arranged transverse to the flow direction, such that fluids flowing in the passage must pass between the rods and the rods forming the rows are offset relative to rods in adjacent rows thereby to require a circuitous flow path for the fluids.” Indeed, FR526178A and Long teach away from such an array as set forth in amended claim 1. As such, the combination of FR526178A and Long fails to teach or suggest each and every element of claim 3. The combination of FR526178A and Long with WO9205946A as set forth by the Examiner fails to cure this deficiency.

In light of the above comments, Applicant respectfully submits that each and every element of claim 3 of the present invention is not taught or suggested by FR526178A, Long or WO9205946A, and therefore claim 3 is in condition for allowance over FR526178A, Long and WO9205946A.

Accordingly, Applicant respectfully requests the Examiner to reconsider and withdraw the rejection of claim 3 under 35 U.S.C. §103(a).

Claim 7

Claim 7 depends from amended claim 1 and as such incorporates each and every element of claim 1. For the reasons discussed above Applicants respectfully submit that neither FR526178A nor Long teaches nor suggests each and every element of amended claim 1. Specifically, FR526178A and Long fails to teach or suggest “an array of adjacent circular

section rods arranged in rows, each row being generally co-aligned and arranged transverse to the flow direction, such that fluids flowing in the passage must pass between the rods and the rods forming the rows are offset relative to rods in adjacent rows thereby to require a circuitous flow path for the fluids.” Indeed, FR526178A and Long teach away from such an array as set forth in amended claim 1. As such, the combination of FR526178A and Long fails to teach or suggest each and every element of claim 7. The combination of FR526178A and Long with JP403054354A as set forth by the Examiner fails to cure this deficiency.

In light of the above comments, Applicants respectfully submit that each and every element of claim 7 of the present invention are not taught or suggested by FR526178A, Long, or JP403054354A, and therefore claim 7 is in condition for allowance over FR526178A, Long, and JP403054354A.

Accordingly, Applicant respectfully requests the Examiner to reconsider and withdraw the rejection of claim 7 under 35 U.S.C. §103(a).

Claims 10 and 11

Claims 10 and 11 depend from amended claim 1 and as such incorporate each and every element of claim 1. For the reasons discussed above Applicant respectfully submits that neither FR526178A nor Long teaches or suggests each and every element of claim 1. Specifically, FR526178A and Long fail to teach or suggest “an array of adjacent circular section rods arranged in rows, each row being generally co-aligned and arranged transverse to the flow direction, such that fluids flowing in the passage must pass between the rods and the rods forming the rows are offset relative to rods in adjacent rows thereby to require a circuitous flow path for the fluids.” Indeed, FR526178A and Long teach away from such an array as set forth in amended claim 1. As such, the combination of FR526178A and Long fails to teach or suggest each and every element of claims 10 and 11. The combination of FR526178A and Long with Ko as set forth by the Examiner fails to cure this deficiency.

In light of the above amendments and comments, Applicant respectfully submits that each and every element of claims 10 and 11 are not taught or suggested by FR526178A, Long, or Ko, and therefore claims 10 and 11 are in condition for allowance over FR526178A, Long, and Ko.

Accordingly, Applicant respectfully requests the Examiner to reconsider and withdraw the rejection of claims 10 and 11 under 35 U.S.C. §103(a).

Claims 12 and 13

Claims 12 and 13 depends from amended claim 1 and as such incorporate each and every element of claim 1. For the reasons discussed above Applicants respectfully submit that neither FR526178A nor Long teaches nor suggests each and every element of claim 1. Specifically, FR526178A and Long fail to teach or suggest “an array of adjacent circular section rods arranged in rows, each row being generally co-aligned and arranged transverse to the flow direction, such that fluids flowing in the passage must pass between the rods and the rods forming the rows are offset relative to rods in adjacent rows thereby to require a circuitous flow path for the fluids.” Indeed, FR526178A and Long teach away from such an array as set forth in amended claim 1. As such, the combination of FR526178A and Long fails to teach or suggest each and every element of claims 12 and 13. The combination of FR526178A and Long with Ko and Elliot as set forth by the Examiner fails to cure this deficiency.

In light of the above amendments and comments, Applicant respectfully submit that each and every element of claims 12 and 13 are not taught or suggested by FR526178A, Long, Ko, or Elliot, and therefore claims 12 and 13 are in condition for allowance over FR526178A, Long, Ko, and Elliot.

Accordingly, Applicant respectfully requests the Examiner to reconsider and withdraw the rejection of claims 10 and 11 under 35 U.S.C. §103(a).

Rejections under 35 USC § 102

Claims 1, 2, 4-6, and 14 stand under 35 U.S.C. under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 2,068,421 to Long et al. (Hereafter “Long”). Applicant respectfully traverses this rejection in view of the above amendments and the following arguments.

Claim 2 is cancelled by the foregoing amendment, and therefore, Applicant considers the rejection of claim 2 moot.

As stated above and previously argued, Long is not directed to “an array of adjacent circular section rods arranged in rows, each row being generally co-aligned and arranged transverse to the flow direction, such that fluids flowing in the passage must pass between the rods and the rods forming the rows are offset relative to rods in adjacent rows thereby to require a circuitous flow path for the fluids” as set forth in amended claim 1. Long clearly teaches that circular section rods are arranged transversely to each other. That is, there is one row of tubes 30 which are separated by another row of tubes 29 that run perpendicular to the first row of tubes 30.

Accordingly, amended claim 1 is not anticipated by Long. Since claims 4-6 and 14 depend from claim 1, claims 4-6 and 14 incorporate each and every element of amended claim 1. Thus claims 3-7, 9-14 and 16-18 are also not anticipated by Long.

In light of the above comments, Applicant respectfully submits that each and every element of claims 1, 4-6, and 14 are not disclosed by Long and therefore claims 1, 4-6, and 14 are in condition for allowance over Long.

Accordingly, Applicant respectfully requests the Examiner to reconsider and withdraw the rejection of claims 1, 4-6, and 14 under 35 U.S.C. §102.

Previous Rejections under 35 USC § 103

It is unclear whether the Examiner has maintained the previous rejection under 35 U.S.C. 103. The Examiner had previously rejected Claims 8, 9, and 16-18 under 35 U.S.C. 103 as being unpatentable over Long. Claim 3 was rejected under 35 U.S.C. 103(a) as being unpatentable over Long in view of WO9205946A. Claim 7 was rejected under 35 U.S.C. 103(a) as being unpatentable over Long in view of JP403054354A. Claims 10 and 11 are rejected under 35 U.S.C. 103 as being unpatentable over Long in view of U.S. Patent No. 5,331,943 to Ko (hereafter “Ko”). Claims 12 and 13 are rejected under 35 U.S.C. 103 as being unpatentable over Long in view of U.S. Patent No. 4,437,968 to Elliot, (hereafter “Elliot”). If the rejection has been maintained, Applicant respectfully traverses these rejections in view of the above amendments and the following arguments.

Claim 3

Claim 3 depends from claim 1 and as such incorporates each and every element of amended claim 1. As discussed above, Long neither teaches nor suggests each and every element of amended claim 1. Specifically, Long fails to teach or suggest “an array of adjacent circular section rods arranged in rows, each row being generally co-aligned and arranged transverse to the flow direction, such that fluids flowing in the passage must pass between the rods and the rods forming the rows are offset relative to rods in adjacent rows thereby to require a circuitous flow path for the fluids.” Indeed, Long teaches away from such an array as set forth in amended claim 1. As such, Long fails to teach or suggest each and every element of claim 3. The combination of Long with WO9205946A as set forth by the Examiner fails to cure this deficiency.

In light of the above amendments and comments, Applicant respectfully submits that each and every element of claim 3 is not taught or suggested by either Long or WO9205946A, and therefore claim 3 is in condition for allowance over Long and WO9205946A.

Accordingly, Applicant respectfully requests the Examiner to reconsider and withdraw the rejection of claim 3 under 35 U.S.C. §103(a).

Claim 7

Claim 7 depends from amended claim 1 and as such incorporates each and every element of claim 1. As discussed above, Long neither teaches nor suggests each and every element of amended claim 1. Specifically, Long fails to teach or suggest “an array of adjacent circular section rods arranged in rows, each row being generally co-aligned and arranged transverse to the flow direction, such that fluids flowing in the passage must pass between the rods and the rods forming the rows are offset relative to rods in adjacent rows thereby to require a circuitous flow path for the fluids.” Indeed, Long teaches away from such an array as set forth in claim 1. As such, Long fails to teach or suggest each and every element of claim 7. The combination of Long with JP403054354A as set forth by the Examiner fails to cure this deficiency.

In light of the above amendments and comments, Applicant respectfully submits that each and every element of claim 7 is not taught or suggested by either Long or JP403054354A, and therefore claim 7 is in condition for allowance over Long and JP403054354A.

Accordingly, Applicant respectfully requests the Examiner to reconsider and withdraw the rejection of claim 7 under 35 U.S.C. §103(a).

Claims 8, 9 and 16-18

Claim 8 is cancelled by the foregoing amendment, and therefore, Applicant considers the rejection of claim 8 moot.

Claims 9 and 16-18 depend from amended claim 1 and as such incorporate each and every element of claim 1. As discussed above Long fails to teach or suggest each and every element of amended claim 1. Specifically, Long fails to teach or suggest “an array of adjacent circular section rods arranged in rows, each row being generally co-aligned and arranged transverse to the flow direction, such that fluids flowing in the passage must pass between the rods and the rods forming the rows are offset relative to rods in adjacent rows thereby to require a circuitous flow path for the fluids.” Indeed, Long teaches away from such an array as set forth in amended claim 1. As such, Long fails to teach or suggest each and every element of claims 9 and 16-18.

In light of the above comments, Applicants respectfully submit that each and every element of claims 9 and 16-18 is not taught or suggested by Long, and therefore claims 9 and 16-18 are in condition for allowance over, Long.

Accordingly, Applicant respectfully requests the Examiner to reconsider and withdraw the rejection of claims 9 and 16-18 under 35 U.S.C. §103(a).

Claims 10 and 11

Claims 10 and 11 depends from amended claim 1 and as such incorporate each and every element of claim 1. As discussed above, Long neither teaches nor suggests each and every element of amended claim 1. Specifically, Long fails to teach or suggest “an array of adjacent circular section rods arranged in rows, each row being generally co-aligned and arranged transverse to the flow direction, such that fluids flowing in the passage must pass between the rods and the rods forming the rows are offset relative to rods in adjacent rows thereby to require a circuitous flow path for the fluids.” Indeed, Long teaches away from such an array as set forth in amended claim 1. As such, Long fails to teach or suggest each and every element of claims 10 and 11. The combination of Long with Ko as set forth by the Examiner fails to cure this deficiency.

In light of the above amendments and comments, Applicant respectfully submits that each and every element of claims 10 and 11 is not taught or suggested by either Long or Ko, and therefore claims 10 and 11 are in condition for allowance over Long and Ko.

Accordingly, Applicant respectfully requests the Examiner to reconsider and withdraw the rejection of claims 10 and 11 under 35 U.S.C. §103(a).

Claims 12 and 13

Claims 12 and 13 depends from amended claim 1 and as such incorporates each and every element of claim 1. As discussed above, Long neither teaches nor suggests each and every element of amended claim 1. Specifically, Long fails to teach or suggest “an array of adjacent circular section rods arranged in rows, each row being generally co-aligned and arranged transverse to the flow direction, such that fluids flowing in the passage must pass between the rods and the rods forming the rows are offset relative to rods in adjacent rows thereby to require a circuitous flow path for the fluids.” Indeed, Long teaches away from such an array as set forth in amended claim 1. As such, Long fails to teach or suggest each and every element of claims 12 and 13. The combination of Long with Ko and Elliot as set forth by the Examiner fails to cure this deficiency.

In light of the above amendments and comments, applicant respectfully submits that each and every element of claims 12 and 13 is not taught or suggested by either long Ko, or Elliot and therefore claims 12 and 13 are in condition for allowance over long, Ko, and Elliot.

Accordingly, Applicant respectfully requests the Examiner to reconsider and withdraw the rejection of claims 12 and 13 under 35 U.S.C. §103(a).

CONCLUSION

In view of the remarks set forth above, Applicants contend that Claims 1, 3-7, 9-14 and 16-18 are presently pending in this application, are patentable, and in condition for allowance. If the Examiner deems there are any remaining issues, we invite the Examiner to call the undersigned at (617) 227-7400.

In view of the above amendment, applicant believes the pending application is in condition for allowance.

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